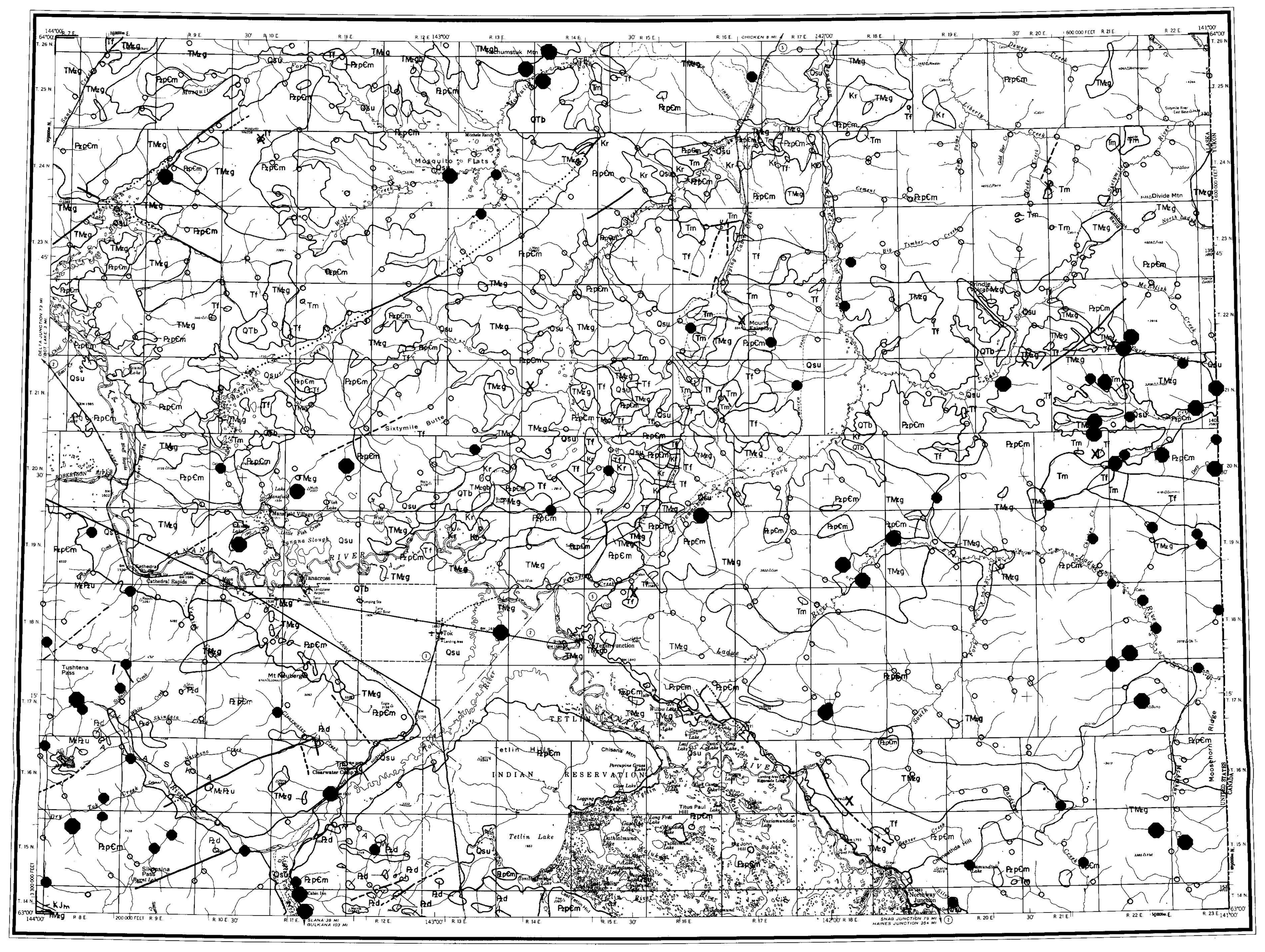
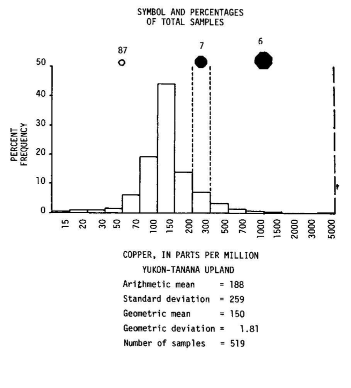
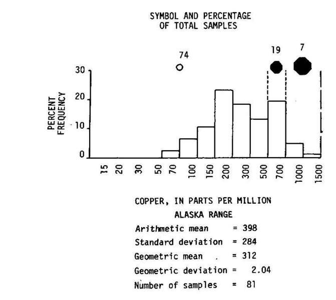
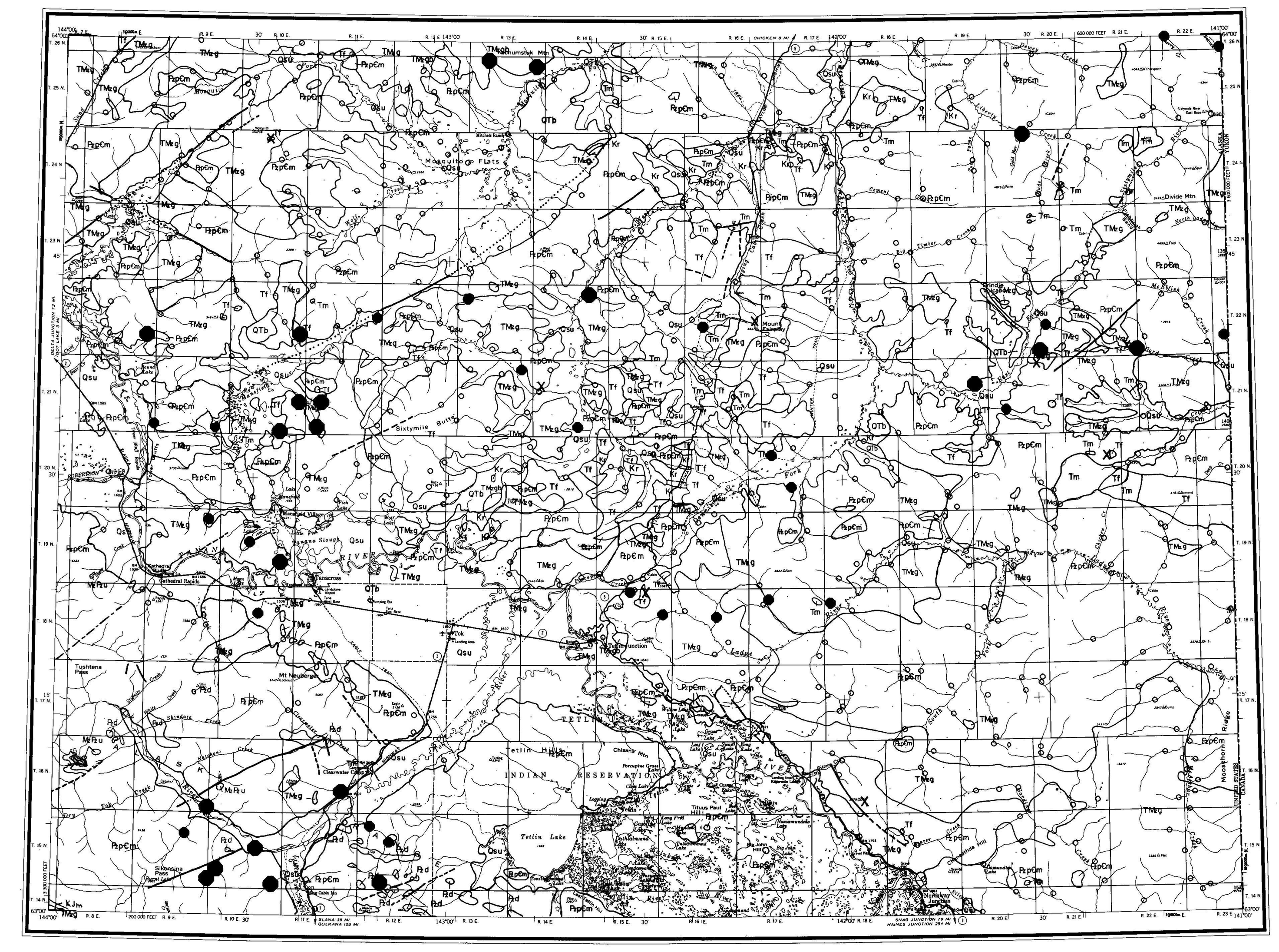
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

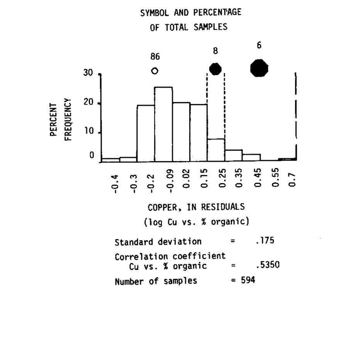


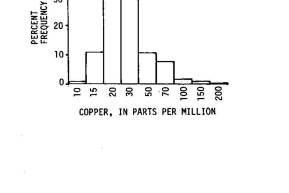




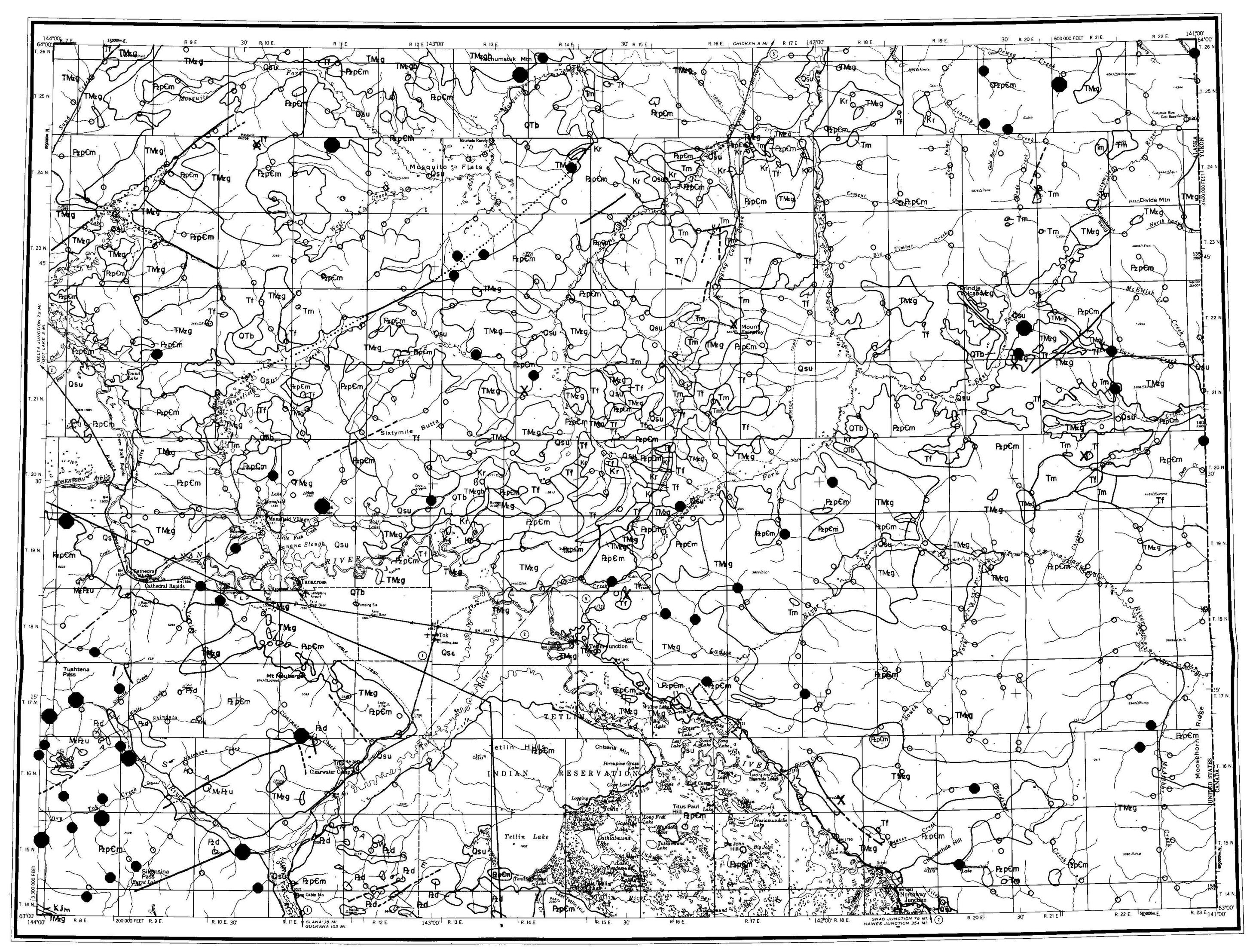
A. Copper in the oxide residue of stream sediment

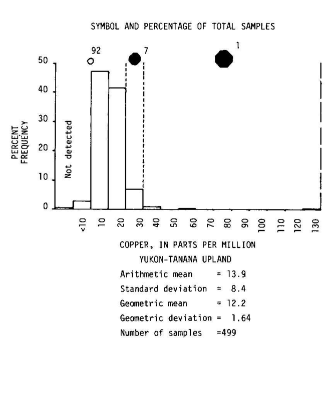


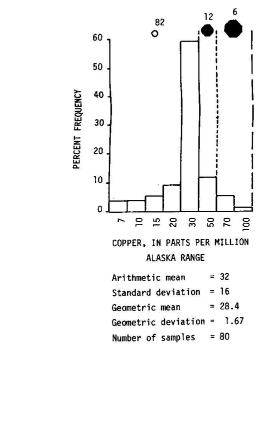




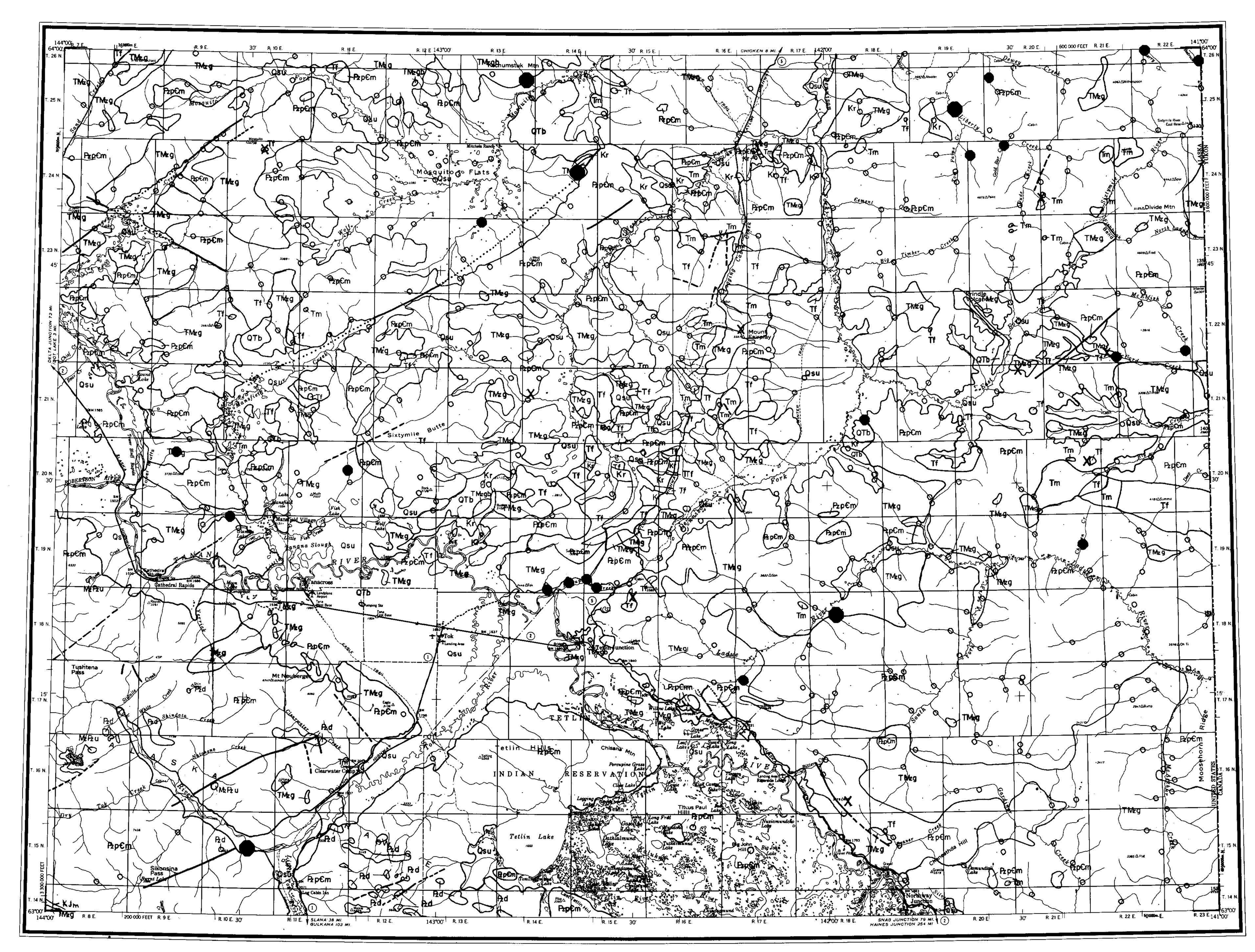
C. Copper in the ash of streambank sod

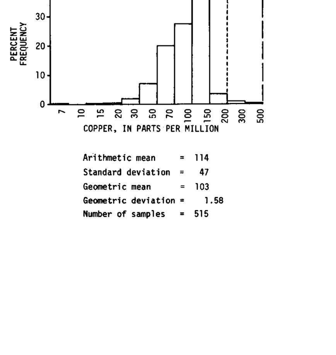






B. Copper in the minus-80-mesh stream sediment





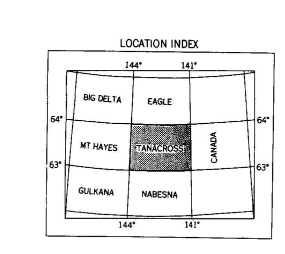
D. Copper in the ash of aquatic bryophytes (mosses)

BASE FROM U. S. GEOLOGICAL SURVEY, 1:250,000, TANACROSS QUADRANGLE, 1964

Scale 1:500,000
1 inch equals approximately 8 miles

Miles

Kilometers



GEOCHEMICAL MAPS SHOWING THE DISTRIBUTION AND ABUNDANCE OF COPPER IN THE TANACROSS QUADRANGLE, ALASKA

BY

G. C. CURTIN, G. W. DAY, R. M. O'LEARY, S. P. MARSH, AND R. B. TRIPP

1976

BACKGROUND INFORMATION RELATING TO THIS MAP IS PUBLISHED AS U.S. GEOLOGICAL SURVEY CIRCULAR 734, AVAILABLE FREE OF CHARGE FROM THE U.S. GEOLOGICAL SURVEY, RESTON, VA. 22092

For sale by U. S. Geological Survey, price $.50

EXPLANATION

GEOLOGY GENERALIZED FROM FOSTER (1970)

CORRELATION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

Qsu — QUATERNARY

SEDIMENTARY ROCKS

Kr — CRETACEOUS(?)

KJm — CRETACEOUS OR JURASSIC

IGNEOUS AND METAMORPHIC ROCKS

QTb — QUATERNARY AND TERTIARY

Tm, Tf — TERTIARY(?)

TMzg, TMzgb — TERTIARY OR MESOZOIC

MzPu — MESOZOIC OR PALEOZOIC

Pd — PALEOZOIC(?)

PpCm — PALEOZOIC AND (OR) PRECAMBRIAN

DESCRIPTION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

Qsu — UNCONSOLIDATED SEDIMENTARY DEPOSITS

SEDIMENTARY ROCKS

Kr — DETRITAL ROCKS (CRETACEOUS?)

KJm — MENTASTA ARGILLITE OF RICHTER (1967) (JURASSIC OR CRETACEOUS)

IGNEOUS AND METAMORPHIC ROCKS

QTb — BASALT

Tm — MAFIC VOLCANIC ROCKS

Tf — FELSIC TUFF, WELDED TUFF, LAVA, AND HYPABYSSAL INTRUSIVE ROCKS

TMzg — GRANITIC ROCKS, UNDIVIDED

TMzgb — GABBRO

MzPu — ULTRAMAFIC ROCKS

Pd — DIORITE

PpCm — METAMORPHIC ROCKS, UNDIVIDED

GEOLOGIC SYMBOLS

CONTACT, APPROXIMATELY LOCATED

FAULT, DASHED WHERE APPROXIMATELY LOCATED, DOTTED WHERE CONCEALED. U, UPTHROWN SIDE; D, DOWNTHROWN SIDE

FAULT OR LINEAMENT FROM AERIAL PHOTOGRAPHS

LINE SEPARATES NORTHERN (YUKON-TANANA UPLAND) POPULATION OF GEOCHEMICAL SAMPLES FROM SOUTHERN (ALASKA RANGE) POPULATION

X BASE METAL PROSPECTS NORTH OF THE TANANA RIVER

GEOCHEMICAL SYMBOLS

BACKGROUND VALUES

WEAKLY ANOMALOUS VALUES

STRONGLY ANOMALOUS VALUES

DISCUSSION

This series of geochemical maps shows the distribution of copper in four sample media: (A) the oxide residue (the oxalic-acid-leachable fraction) of the stream sediment, (B) the minus-80-mesh stream sediment, (C) the ash of streambank sod (mixed organic and inorganic material) collected beneath the water level, and (D) the ash of aquatic bryophytes (mosses). The copper data are plotted on base maps showing generalized geology and the drainage pattern. The map symbols show the sample sites and ranges of values in the following manner: (1) open symbols denote background, (2) small black symbols represent weakly anomalous values, and (3) large black symbols denote strongly anomalous values. Because the small black symbols represent weakly anomalous values, they are considered to be significant only where they are closely associated with strongly anomalous metal values either in the same sample medium or with anomalous values in other sample media. The ranges of values represented by the symbols are shown on the histograms which accompany the geochemical maps. An explanation of sampling, preparation, and analytical procedures is given in Circular 734, which accompanies this folio. Complete analytical data for geochemical samples collected by the U.S. Geological Survey in the Tanacross quadrangle are available in a U.S. Geological Survey open-file report (O'Leary and others, 1976).

Of the four sample media, the oxide residue (mainly secondary iron-manganese oxides) of stream sediment and the aquatic bryophytes act as scavenging agents of ions in solution in the stream waters. The copper content of these media, therefore, is indicative of the amounts of copper migrating in solution from bedrock and colluvium. The copper content of the streambank sod represents both copper scavenged from solution by the organic material and the copper content of the detrital material in the sod. The copper content of the minus-80-mesh stream sediment, on the other hand, mainly represents the amount of copper within the detrital material of the stream sediment.

Copper values in the ash of streambank sod show a relatively high positive correlation with the organic content of the sample. This high correlation suggests that the amount of organic material noticeably influences the copper content of the sod. A regression analysis--log copper vs. organic content--was used to determine the influence of organic content on the variation of copper values in the ash of the sod. This type of analysis allows separation of those high copper values that reflect the concentration of background amounts of copper by organic material from those high values that are derived from a mineralized source. Values from the regression analysis--shown as residuals--were used on the geochemical map (fig. C). The distribution of the residuals is shown on the upper of the two accompanying histograms. The lower histogram shows the distribution of original copper concentrations in the ash of the streambank sod.

The copper values in the ash of aquatic bryophytes were not adjusted on the basis of percent of organic material because the organic content of the bryophytes shows little variation.

The histograms and other statistical data for copper in the oxide residue of stream sediment (fig. A) and in the minus-80-mesh stream sediment (fig. B) show two populations. One population (generally lower values) represents the copper content of the samples collected in the maturely dissected, forested terrain of the Yukon-Tanana Upland--that part of the quadrangle north of the Tanana River. The other population of generally higher copper values represents samples collected in the rugged, mountainous terrain of the Alaska Range--south and west of the heavy black line on the map. In the maturely dissected terrain, chemical weathering is probably the main factor controlling the mobility of copper. This type of weathering may be characterized by the solution of sulfide and other minerals and a general dispersion and impoverishment of copper and other base metals in the weathering zone. In the rugged mountainous terrain, on the other hand, mechanical weathering is the primary process controlling element dispersion. In this environment, impoverishment of metals in the weathering zone due to chemical processes is a minor factor.

In the terrain north of the Tanana River, anomalous copper values in the oxide residue of the stream sediment (fig. A), and to a lesser degree in the other three sample media, delineate known mineralized zones and several potential areas of mineralized rock. The most prominent anomalous area is near the east border of the quadrangle (fig. A). Several of the anomalous values in the northern part of the zone represent samples collected in streams draining an area where there is at least one porphyry copper prospect--in T. 22 N., R. 21 E. In this area, scattered anomalous copper values in the minus-80-mesh stream sediment (fig. B), and in the ash of streambank sod (fig. C) and of aquatic bryophytes (fig. D), roughly correlate with the anomalous values in the oxide residue of the stream sediment. The scattered anomalous copper values in the oxide residue south of this area suggest the presence of additional zones of mineralized rock.

A cluster of high copper values in the ash of streambank sod (fig. C) indicates an anomalous zone in the west-central part of the quadrangle. Scattered anomalous copper values in the other sample media in the vicinity of the high copper values in sod ash suggest a rather extensive area that should be explored further. Anomalous molybdenum, lead, zinc, and arsenic values in this same general area (Curtin, Day, Carten, Marsh, and Tripp, 1976; Curtin and others, 1976b, c; Curtin, O'Leary, and Carten, 1976) give further evidence of mineralization in this part of the quadrangle.

In that part of the quadrangle north of the Tanana River, six base metal prospects were not defined by high copper values in the four sample media. These prospects are located in T. 24 N., R. 10 E.; T. 21 N., R. 14 E.; T. 21 N., R. 16 E.; T. 18 N., R. 15 E.; T. 16 N., R. 18 E.; and in T. 24 N., R 20 E. The surface features of at least two of the prospects are similar to those of two occurrences of porphyry copper mineralization that were outlined by high copper values in one or more of the sample media. The absence of high copper values around these prospects, however, indicates either that the copper content of the altered and mineralized rock is low or that the amount of mineralized rock is too small to produce copper-bearing dispersion trains that could be detected at the sampling density used in this study.

The results demonstrate that copper occurrences are more completely defined by the use of a combination of sample media than by any one of the sample media when used alone.

Patterns defining areas of copper potential are shown on the composite geochemical map of copper and molybdenum distribution (Curtin and others, 1976a), which is included in this folio.

REFERENCES CITED

Curtin, G. C., Day, G. W., Carten, R. B., Marsh, S. P., and Tripp, R. B., 1976, Geochemical maps showing the distribution and abundance of molybdenum in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767G, 1 sheet, scale 1:500,000.

Curtin, G. C., Day, G. W., O'Leary, R. M., Marsh, S. P., and Tripp, R. B., 1976a, Composite geochemical map of anomalous copper and molybdenum distribution in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767M, 1 sheet, scale 1:250,000.

______1976b, Geochemical maps showing the distribution and abundance of lead in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767H, 1 sheet, scale 1:500,000.

______1976c, Geochemical maps showing the distribution and abundance of zinc in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767I, 1 sheet, scale 1:500,000.

Curtin, G. C., O'Leary, R. M., and Carten, R. B., 1976, Geochemical maps showing the distribution and abundance of arsenic in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767J, 1 sheet, scale 1:500,000.

Foster, H. L., 1970, Reconnaissance geologic map of the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-593, scale 1:250,000.

O'Leary, R. M., McDanal, S. K., McDougal, C. M., Day, G. W., Curtin, G. C., and Foster, H. L., 1976, Spectrographic and chemical analyses of geochemical samples and related data from the Tanacross quadrangle, Alaska: U.S. Geol. Survey open-file rept. 76-422, 94 p.